HOW DO HIGH SCHOOL STUDENTS PREFER TO LEARN?

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ABSTRACT

The purpose of this study was to examine learning preference—the match between learners and learning methods—and students' information behaviour in technology-rich information environments. The major question asked was: How will high school students' information behaviour differ by gender and academic interests? A total of 88 students (37 girls, 51 boys) from a predominantly African American high school district in the south of the United States participated in the study. The Integrated Communications Technology Learning (ICTL) survey was used to examine differences in high school students' learning preference for information seeking, information sharing and classroom learning. High school girls and students with Science, Technology, Engineering and Math (STEM) interest were found to be significantly more positive toward learning in the traditional classroom.

KEYWORDS

Information behavior; Learning preference; High school

1. INTRODUCTION

Weiler (2005, pp. 46) posited that "the entire world, is currently in the middle of a massive and wide ranging shift in the way knowledge is disseminated and learned." Information and Communication Technology (ICT) tools now offer previously unavailable options for interaction with information for informal-to-formal learning. Additionally, many students use ICT options for rapid information access, messaging, and online connection in their personal lives and many would welcome opportunities to use these networking tools for formal-to-informal learning (Rennie & Morrison, 2013). Yet, even as there is a trend towards online learning, there is little research on the effect of match or mismatch of learners to their preference of learning methods for learning in traditional and technology-mediated learning environments (Curry 1981). The rapid growth of personal technologies throughout the world and the rapid emergence of mobile technologies and applications (Henríquez & Organista, 2012; Khaddage & Knezek 2012) increases the need for studies that can help clarify how students view the use of technology-mediated communications tools for knowledge construction and how students' views may relate to learning outcomes. Research on the psychology of learning indicates that learner attitudes relate to learning outcomes (Driscoll, 2005). Additionally, learning preference has been linked to academic performance (Koch et al., 2011) and to motivation for learning-related activities (Hong & Milgram, 2000). This study of the learning preference of students in one school district is part of the authors' ongoing research on the role of student learning preference to academic goals. This study also includes an examination of the reliability and consistency of the Integrated Communications Technology Learning (ICTL) survey to gauge high school students' learning preferences for three categories of informal-to-formal learning interaction—classroom learning, ICT information seeking, and ICT information sharing.

2. CONCEPTUAL RATIONALE

2.1 Learning Options

Communication is an integral aspect of learning (Warren & Wakefield, 2012). ICT tools offer previously unavailable options for interaction with information for informal-to-formal learning. As the newest personal technology tools blur the line between informal and formal learning (Cox, 2012; Mills, Knezek & Khaddage, 2014; Henríquez & Organista, 2012; Khaddage & Knezek, 2012), mobile technologies are gradually becoming more geographically dispersed (Castells, 2011) and more readily available to students. The many new ICT tools provide a choice in options for learning. Student choices and preferences are related to learning and they warrant examination of how students prefer to interact with information and the match between learning options and learning methods (Keefe, 1979; Curry, 1981; Owens & Straton, 1980). Interest in ICT tools for learning is shifting from a focus on what channels and resources are used to an emphasis on how students will encounter, interact, and interpret information that can be sought out with ICT tools (Ilgaz, Mazman, & Altun, 2015).

2.2 Learning Preference

Orhun (2013, p. 1159) stated, "Learning can be expressed as gathering information, processing information, the improvement of thinking, and the method of selection for attaining knowledge." Student preference for a mode of learning is an important variable in the effectiveness of learning (Owens & Straton, 1980). Learning preference is a facet of how we learn. It has been defined in relation to learning style and methods, as how a learner perceives, interacts, and responds to learning opportunities (Keefe, 1979). Mayer and Massa (2003) examined learning preference along with aspects of cognitive ability and cognitive style. They describe learning preference as a distinct aptitude and "property of the learner's interaction with a particular learning situation" (Mayer & Massa, 2003, p. 838). While studies on learning styles have not provided conclusive evidence regarding the effect of learning style on academic performance, Orhun's (2013) research revealed that preferred learning style is potentially a tool for improvement of mathematic performance. Learning preference relates most directly to how students prefer to attain knowledge and was found to be a predictor of academic performance in a study of nursing students, for students those who reported a preference for multiple approaches for learning (Koch et al., 2011). Additionally, Hong and Milgram (2000) reported that learning preference is related to motivation for homework and out-of-school learning.

2.3 Research Questions

The research questions addressed were related to how high school students like to learn. Students' information behavior (information seeking and information sharing) in technology-mediated ICT learning environments, as well as students' liking of classroom learning were examined by gender and academic interest in Science, Technology, Engineering and Math (STEM).

The specific research questions examined were:

1) How are male and female students different in their learning behaviors with regard to information?
2) How are students interested in seeking STEM and non-STEM courses of study different in their learning behavior with regard to the information?

3. RESEARCH METHODS

3.1 Participants

Institutional Review Board approval was granted for this study of learning preference among high school students. Data was gathered using paper and pencil surveys. All high school students, with the exception of those who were not eligible for a school field trip, from the district's only high school were invited to

participate in the study. Eighty-eight of the 296 students who attended the field trip returned permission forms and surveys and were therefore included in the study. Participants were 58% male and 37% female, attending high school grades 9 to 12. Fifty percent of students, *n*=44, indicated that they are interested in seeking a STEM-related career.

3.2 Measurement and Instruments

The Information and Communications Technology Learning (ICTL) survey was designed and validated to address questions relating to students' preferences in utilizing ICT and to assist in understanding individual differences in information behavior. Instrument development included analysis for internal consistency reliability, principal components exploratory factor analysis, multidimensional scaling, and higher order factor analysis (Mills, Knezek & Wakefield, 2013). The original version of the ICTL survey consisted of 16 items to assess three constructs: two of the three are *information seeking* and *information sharing* (Author, 2014). A new construct, *classroom learning*, emerged in analysis of the ICTL for the participants of this study. These constructs were measured on a five-point *Likert* scale ranging from (1) "strongly disagree" to (5) "strongly agree." Exploratory factor analysis indicated an original model for constructs wherein the *information seeking* construct was developed from six items (ic8, ic10, ic11, ic14, ic2, ic13), the *information sharing* construct was created from six items (ic3, ic6, ic15, ic4, ic1, ic16), and the *classroom learning* construct was created from four items (ic9, ic12, ic5, ic7).

Confirmatory factor analysis was performed to validate the scales from exploratory factor analysis. To modify the model, the observed variables that had produced low factor loading (<0.5) were eliminated. The modification indices were consulted for the model modification. Figure 1 presents the final measuring items for each construct and the factor loadings. The models were considered acceptable if CFI ≥ 0.90, GFI ≥ 0.90, AGFI ≥ 0.90, RMSEA ≤ 0.08, and SRMR ≤ 0.10 (Jöreskog & Sörbom, 1993; Hu & Bentler, 1999). Table 1 presents the model fit indices. Based on the outputs, the model was adequately fit with the given data set and was valid and acceptable for measurement.

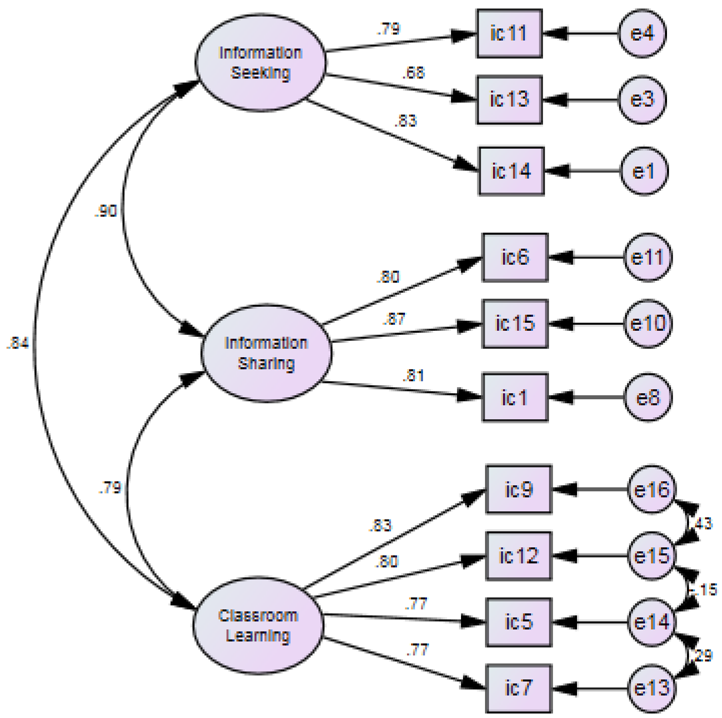

Figure 1. CFA measurement model

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Table 1. Goodness-of-fit indices for CFA model model fit indices

	CFI	GFI	AGFI	RMSEA	SRMR
Acceptable if	*≥ .900*	*≥ .900*	*≥ .900*	*< .080*	*≤ .100*
ICTL	.970	.898	.806	.083	.042

Note: (Jöreskog & Sörbom, 1993; Hu & Bentler, 1999)

Table 2. Average variance extract and discriminant validity

	Information Seeking	**Information Sharing**	**Classroom Learning**
Information Seeking	0.596		
Information Sharing	0.814	0.679	
Classroom Learning	0.699	0.618	0.628

Note: In the diagonal-running cells, the average variance extracted (AVE) is in bold; the lower-left half of the table shows the squared inter-construct correlation estimates (SIC).

Table 3. Reliability

Constructs	Cronbach's alpha (reliability coefficient)
Information Seeking	0.82
Information Sharing	0.86
Classroom Learning	0.89

All of the Cronbach's alpha results ranged from 0.82 to 0.89. According to Devellis (1991), these reliability estimates can be considered very good. These Cronbach's alphas suggest that the items in each scale were consistent with each other. Convergent validity was examined from the construct reliability and the Average Variance Extract (AVE) of each construct (See Table 2). All three constructs demonstrated adequate convergent validity with an AVE greater than 0.5. However, the constructs demonstrated poor discriminant validity because the *information sharing* and the *information seeking* constructs are highly correlated.

3.3 Analysis

Among the student respondents, 58% of the respondents are male (n=51) and 42% of the respondents are female (n=37). The majority of the respondents are between 15-17 years old (n=49). When asked about their learning behaviors, students reported an average of 3.53 (SD=1.12) of level of agreement on information sharing, 3.91 (SD=.96) on information seeking, and 4.05 (SD=.86) on classroom learning, respectively. These constructed variables were the combination of multiple items. The *information seeking* construct was developed using three statements: More classroom learning should use technology tools; I learn more when I am free to search for the answers on my own; and I use the Internet to keep current on important topics. The *information sharing* construct was developed using three statements: I learn many things by interacting with other Internet users; I like to share information on the Internet with posts and tweets; and I would like to be a member of an Internet learning online community. The *classroom learning* construct was developed using four statements: I learn best in the classroom setting; the things I need to know are taught in the classroom; I like to take classes to learn new things; and I learn many things in the classroom.

A Pearson's Product Moment Correlation analysis revealed significant positive correlations between these aspects of information behavior (r=0.672-0.754, p<.001). To answer research question 1, multiple analysis of variance (MANOVA) was performed to determine the effects of a categorical independent variable (Gender: Male and Female) on three continuous dependent variables including *information seeking*, *information sharing*, and *classroom learning*. Although the groups for the male and female respondents were unequal (51 male students; 37 female students), the Box's M test (Box's M=13.869; F=2.206, p=0.04) was found to be

non-statistically significant based on Huberty and Petoskey's guideline (2000) indicating that the variance-covariance matrices between the groups were equal for the MANOVA purpose.

Generally, female students reported having a higher level of agreement on all three aspects of information behaviors. The one-way MANOVA on learning preference revealed a significant multivariate effect with Wilks' lambda=.87, F(3,84)=4.18, p=.008, $\eta 2$=.130. Approximately 13% of the multivariate variance of the learning preference construct was associated with student gender. The univariate effects revealed statistically significant differences on classroom learning preference where F(1,86)=10.36, p=0.002. To be specific, female students had significantly higher levels of preference for the classroom learning construct (M=4.38, SD=0.65), indicating that their perceptions on classroom learning are more positive than those of male students (M=3.81, SD=0.91). See Table 4.

Table 4. Learning preference by gender

Learning Preference	*n*	Mean	*SD*	*F*	Sig.	Effect Size (Cohen's *d*)
Information Seeking				2.72	.103	0.36 small
Male	51	3.77	.98			
Female	37	4.11	.91			
Information Sharing				1.05	.309	0.21 small
Male	51	3.43	1.08			
Female	37	3.67	1.18			
Classroom Learning				10.36	.002	0.72 large
Male	51	3.81	.91			
Female	37	4.38	.65			

The one-way MANOVA revealed a non-significant multivariate effect with Wilks' lambda=.924, F(3,84)=2.29, p=.084, $\eta 2$=.076. However, through the examination of the univariate effects, we found that there was a statistically significant differences on "classroom learning" preference between STEM and non-STEM students, F(1,86)=6.22, p<.05. To be specific, students with STEM major demonstrated higher level of classroom learning preference (M=4.3, SD=.73) than those of students with non-STEM major (M=3.83, SD=.92). See Table 5.

Table 5. Learning preference by STEM major

Learning Preference	*n*	Mean	*SD*	*F*	Sig.	Effect Size (Cohen's *d*)
Information Seeking				1.91	.171	0.25 small
Non-STEM	44	3.77	.99			
STEM	44	4.01	.92			
Information Sharing				3.77	.056	0.45 small
Non-STEM	44	3.30	1.15			
STEM	44	3.80	1.06			
Classroom Learning				6.22	.015	0.53 medium
Non-STEM	44	3.83	.92			
STEM	44	4.27	.73			

Note: Means are based on ratings from 1 to 5 where 1=*strongly disagree* and 5=*strongly agree*.

3.4 Limitations

Confirmatory factor analysis indicated that while the constructs for *information seeking* and *information sharing* have strong reliability, they are related, as might be expected for two aspects of information behavior and therefore low in discriminant validity. Additional research is planned to determine the extent to which additional question items can improve the discriminant validity by reducing the correlation between the

information seeking and *information sharing* constructs. This research is also limited by the sample of students who are all from one school community, as well as the constraints of self-reported data. Additional research is planned with broader samples of students and observations of actual student information behavior.

4. DISCUSSION AND CONCLUSION

Student attitudes towards learning options, such as information seeking in technology-mediated information environments, provide valuable information to guide in design of instruction and assist in defining useful roles for ICT in informal-to-formal learning. The development of and increased availability of ICT and mobile learning options raise questions about students' tendencies to participate in self-directed learning via ICT and also shed light on students' information behaviors. Students' preferences for use of ICT tools and their information behaviors warrant careful examination because they reveal how students can be expected to interact with information in different learning environments. Additional research is needed to explore the extent to which learning preferences relate to academic outcomes and self-directed learning activities. Validated instrument constructs such as the ICTL i*nformation seeking*, *information sharing*, and *classroom learning* scales can improve teaching and learning by providing an understanding of students' learning preferences for the purpose of supporting instruction and informal-to-formal learning. The scales of the ICTL were found to be acceptable for use in gauging high school students' information behavior preferences for *classroom learning*, *information seeking*, and *information sharing*. The ICTL constructs, as taxonomy built upon empirical data for general, group, and specific factors, may support a theoretical framework for research and experimentation (Cattell, 1987) on information behavior.

Teaching and learning are best facilitated when learning preference can be matched to methods (Keefe, 1979; Curry, 1981; Owens & Straton, 1980). Students' information behavior has been related to critical thinking skills, which are very important to knowledge construction. Weiler (2005, p. 52) pointed out that we assume that students will be effective in seeking information, yet we should be prepared to guide students in developing essential information and critical thinking skills. Findings from this study indicated that regardless of gender and STEM interest, high school students tend to be positive in their perceptions of classroom learning and ICT-mediated information seeking and sharing. As a group, students were most positive toward classroom learning, followed by ICT information seeking, then information sharing. The standout for the students in this study was the classroom learning construct, which when taken into consideration by gender and study major, indicated significant differences of in learning preference between groups. To be specific, female students tend to have a higher preference for classroom learning than male students. Students with STEM interest tend to have a higher preference for classroom learning than non-STEM major students.

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